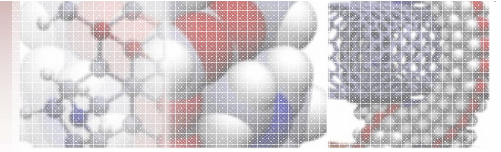


# Studii teoretice si experimentale de jonctiuni in Y pe baza de cristale fotonice

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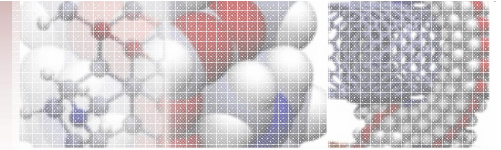
Institutul National de Cercetare-Dezvoltare  
pentru Microtehnologie, Bucuresti, Romania



# Introducere

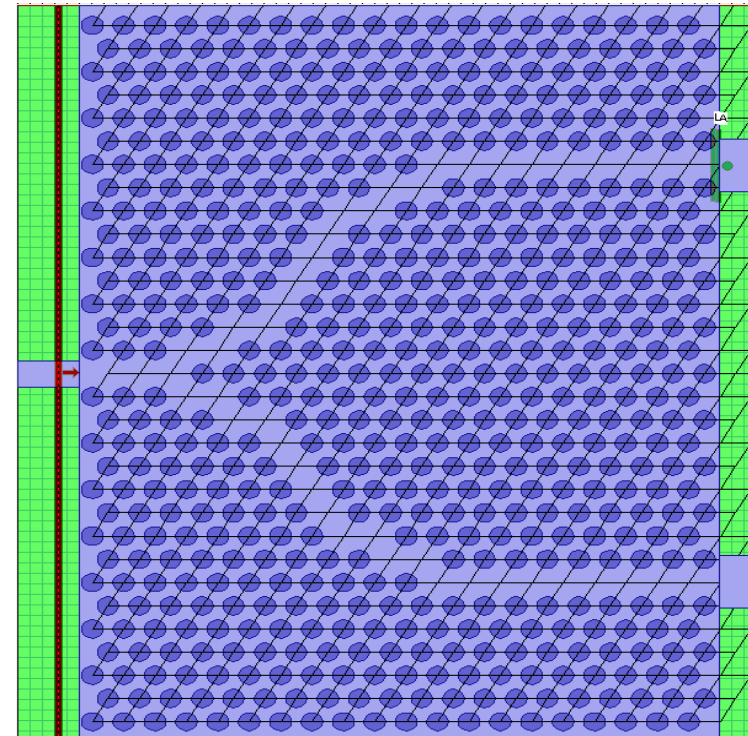
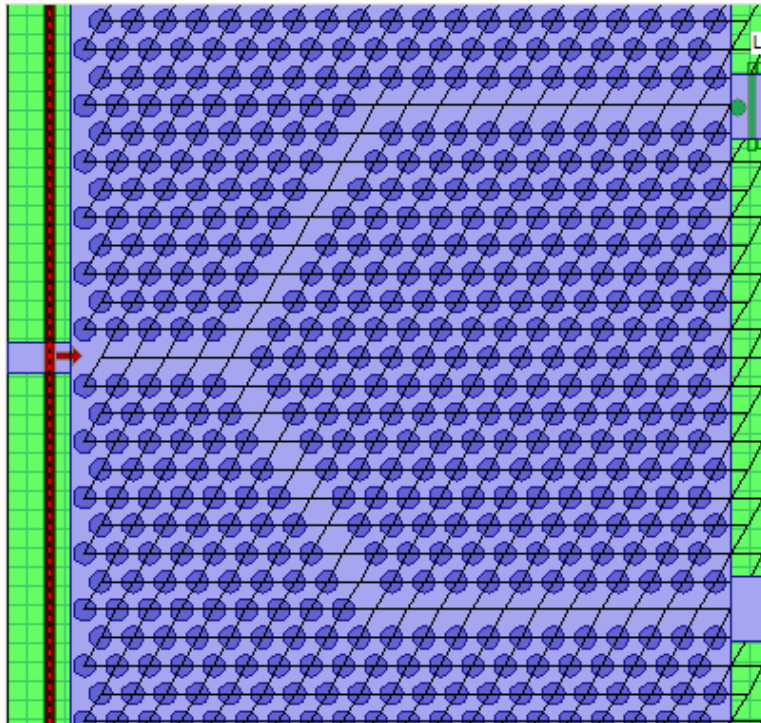
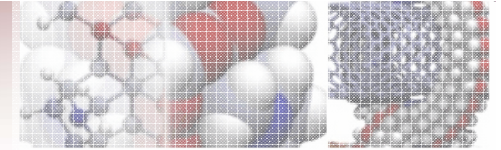
- Lucrarea prezinta rezultatele simularilor si a experimentelor de fabricatie preliminara a divizoarelor de putere de tip jonctiuni in Y in cristale fotonice.
- Cristalele fotonice sunt structuri periodice care au proprietatea de a bloca transmisia radiatiei pentru anumite domenii de lungimi de unda, fapt care permite obtinerea de circuite de tip jonctiuni in Y cu unghi larg in cristale fotonice

## Simulare cristale fotonice



- Structuri de cristal fonic de tip hexagonal cu atomi circulari obtinuti prin corodarea stratului de nitrura de siliciu
- Ghiduri de unda obtinute prin indepartarea atomilor pe anumite portiuni. Pentru scaderea nivelului de pierderi s-a luat in considerare racorduri la 30 de grade dintre ghidul de intrare si cele doua brate ale jonctiunii precum si intre bratele jonctiunii si ghidurile de iesire.
- Pentru simulare s-a utilizat softul specializat OptiFDTD. A fost utilizata o simulare tip 2D ca urmare a utilizarii metodei indicelui efectiv.

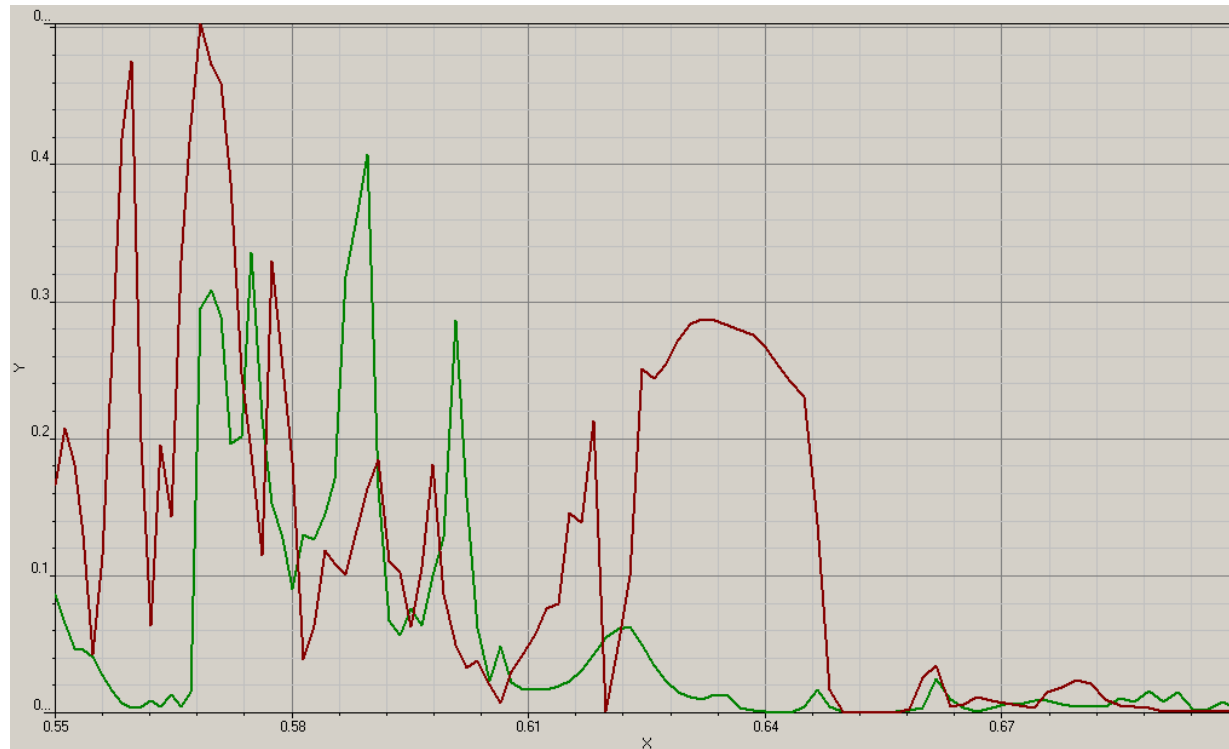
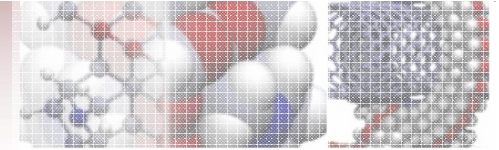
# Simulare cristale fotonice



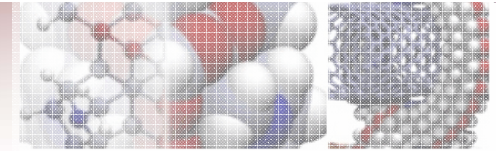
*Layout-ul divizorului de radiatie in cristalul fonic. Jonctiune in Y normala (stanga)*

*Jonctiune in Y cu racorduri de 30 de grade (dreapta)*

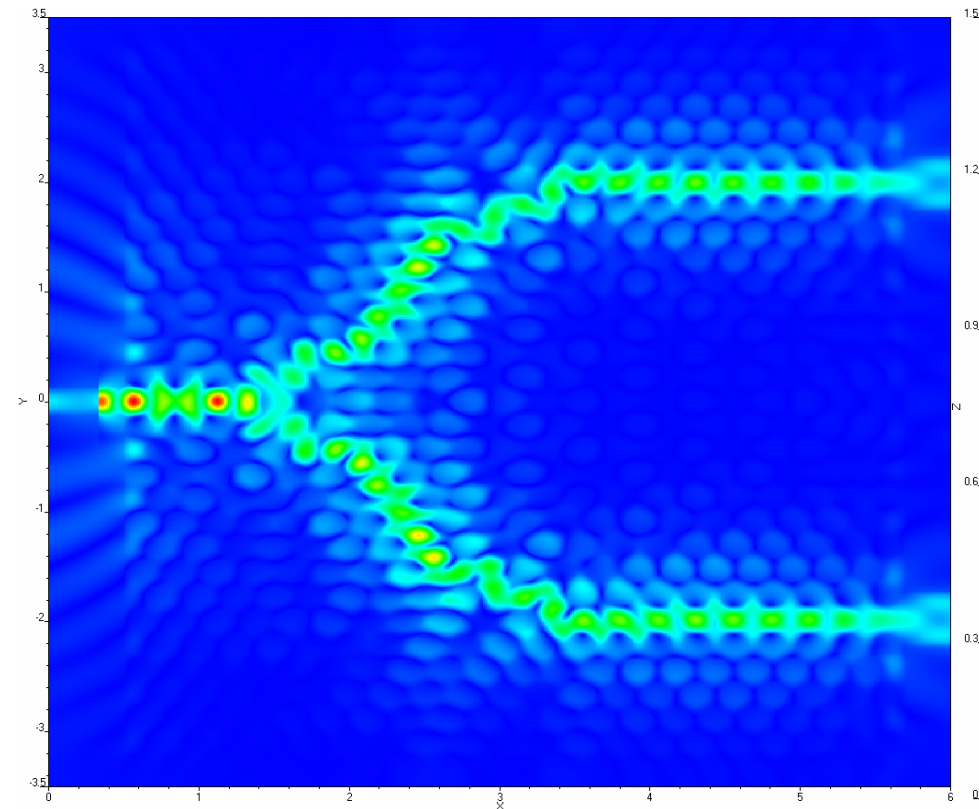
# Simulare cristale fotonice



Spectrul de transmisie pentru jonctiunea in Y normala (linia verde) si respectiv pentru jonctiunea in Y cu racorduri de 30 de grade (linia rosie)

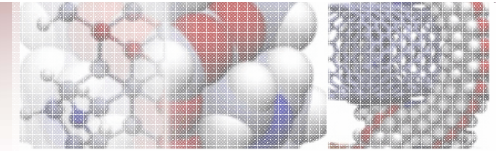


## Simulare cristale fotonice

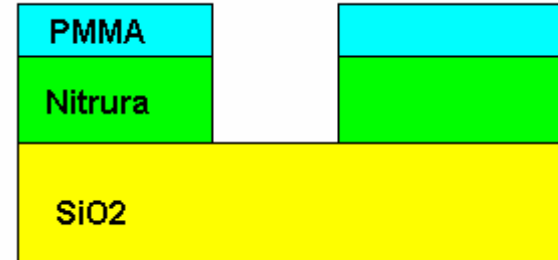


*Propagarea radiatiei prin divizorul de radiatie in cristalul fonic*

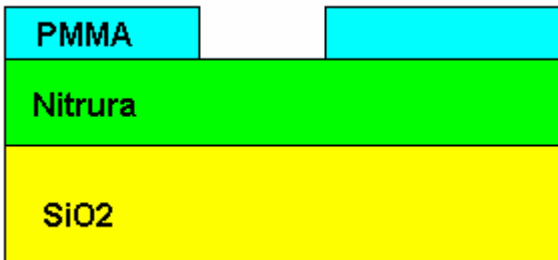
# Experimente de fabricatie



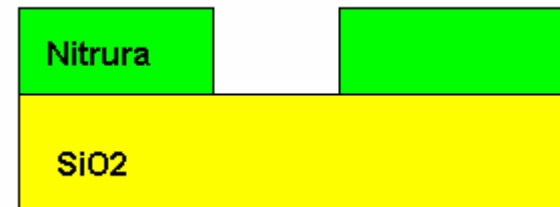
a)



c)

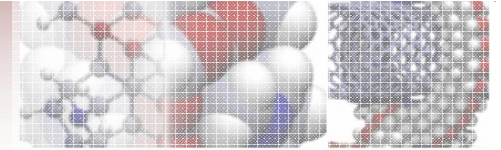


b)



d)

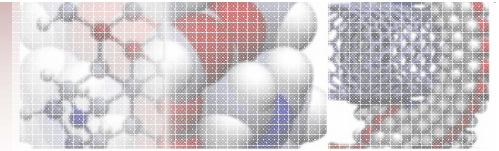
# Experimente de fabricatie



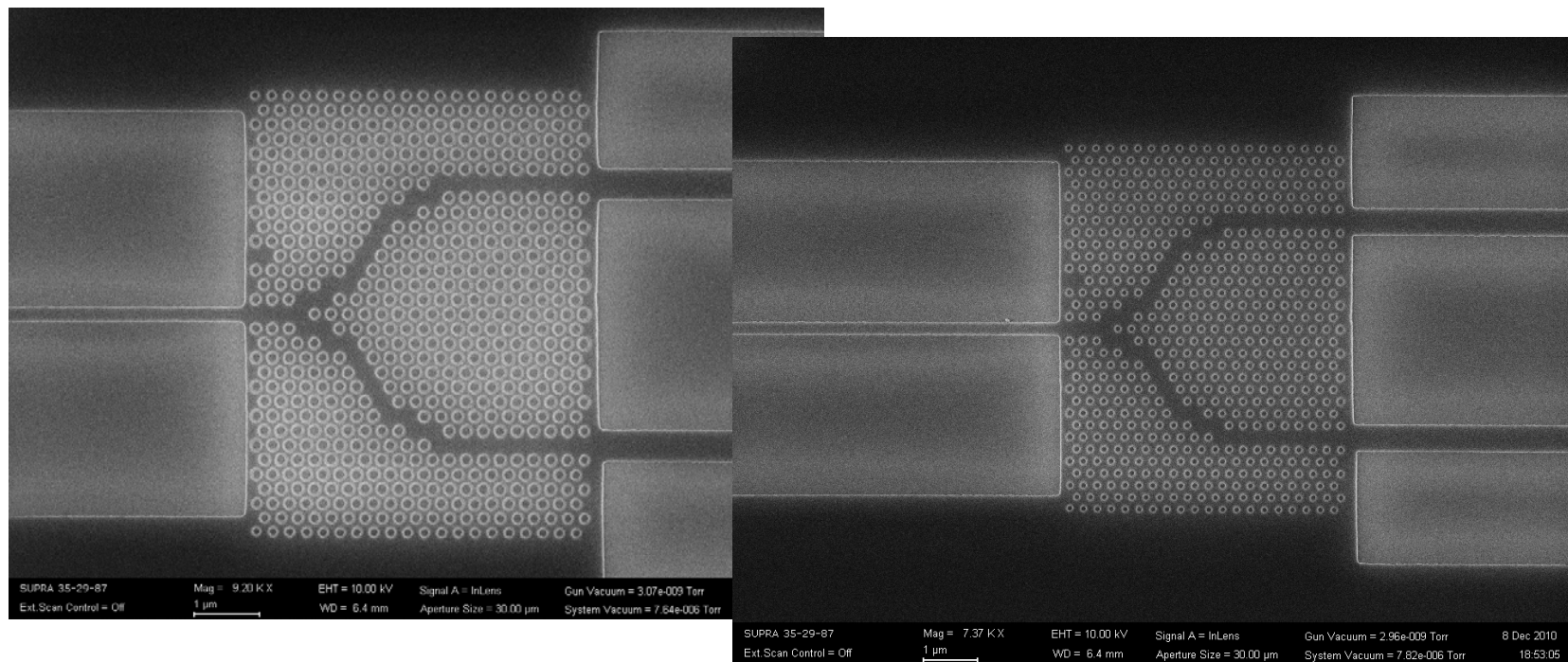
## Parametrii utilizati pentru scrierea cu fascicul de electroni

Tensiunea de acceleratie	30 kV
Curentul de fascicul	150 pA
Apertura	30 $\mu\text{m}$
WD	6.3 mm
Doza arie	330 $\mu\text{C}/\text{cm}^2$
Doza cercuri	1000 pC/cm
Developare	MIBK:IPA ( 1:3)



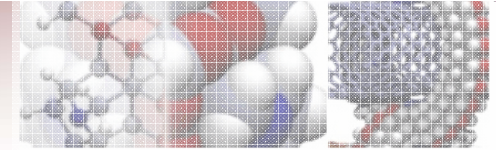


## Experimente de fabricatie



*Imagine SEM: deschideri cu dimensiuni nanometrice obtinute in PMMA- pentru obtinere cristale fotonice*

# Experimente de fabricatie



Sistem de Corodare cu Ioni Reactivi

Producator: Sentech

Model: SI 220

Reteta de corodare:

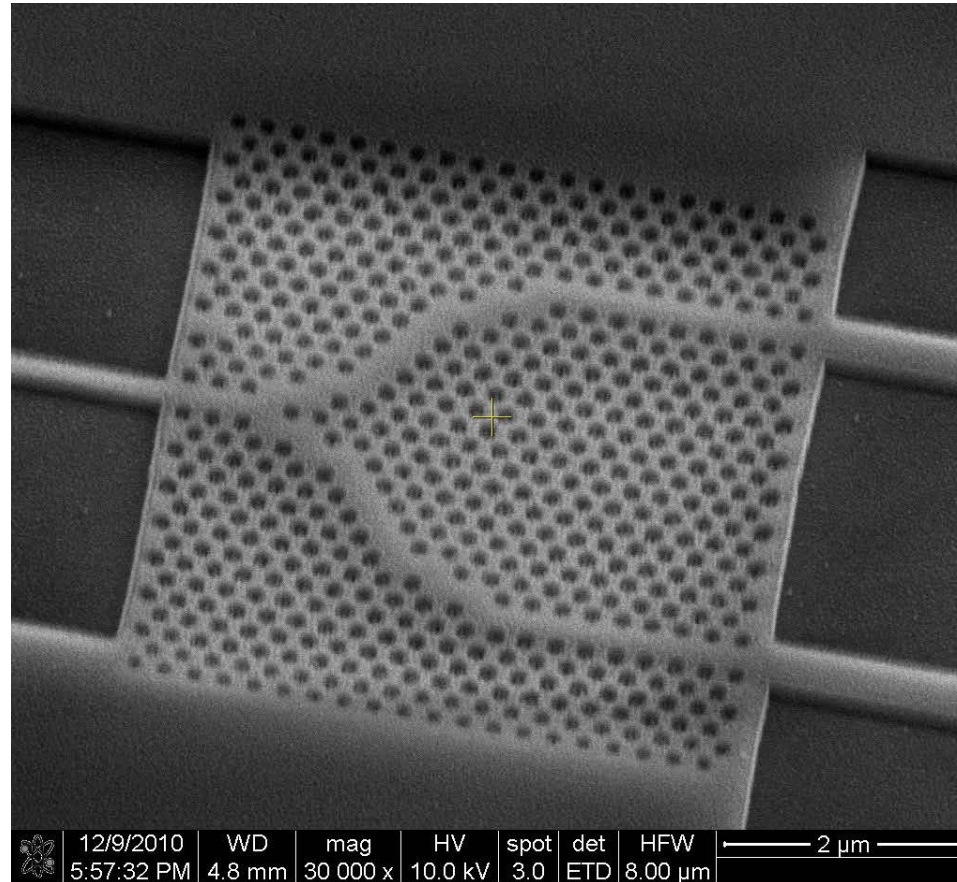
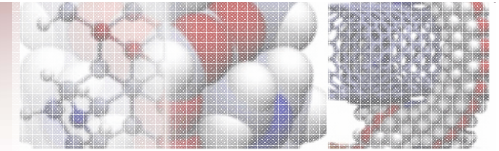
Putere RF: 250 W

Presiune: 20 Pa

Debit O<sub>2</sub>: 10 sccm

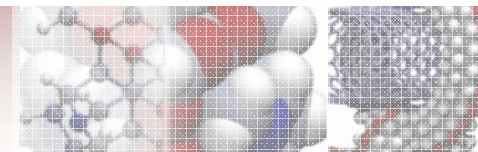
Debit CHF<sub>3</sub>: 40 sccm

# Experimente de fabricatie



Configuratie experimentală de splitter în Y cuplat cu ghiduri optice din  $\text{Si}_3\text{N}_4$ , realizat pe baza de cristale fotonice

# Concluzii



- A fost simulata o configuratie de jonctiuni in Y in cristale fotonice pe baza de racorduri la 30 de grade cu eficienta superioara fata de configuratia normala
- S-au realizat experimente de configurare cristale fotonice prin scrierea cu fascicul de electroni in PMMA si corodarea in RIE a nitrurii de siliciu prin masca de PMMA.